Charles Darwin University

Final Examination

Family Name						
Given Name/s						
Student Number						
Teaching Period	Semester 1, 2019					

PHA311 – Clinical Biochemistry	DURATION	
	Reading Time:	10 minutes
	Writing Time:	180 minutes

INSTRUCTIONS TO CANDIDATES

The examination has A and B sections

Section A: Suggested Time: 90 minutes
Answer ALL 7 questions on the booklet provided. Marks: 50

Section B: Suggested Time: 90 minutes
Answer ALL 4 questions in the booklet provided. Marks: 50

Note that questions ARE NOT of equal value.

Read ALL questions carefully.

EXAM CONDITIONS

You may begin writing from the commencement of the examination session. The reading time indicated above is provided as a guide only.

This is a CLOSED BOOK examination

Any non-programmable calculator is permitted

No handwritten notes are permitted

No dictionaries are permitted

ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED
No additional printed material is permitted	1 x 20 Page Book 1 x Scrap Paper

THIS EXAMINATION IS PRINTED DOUBLE-SIDED.

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Section A

Short Essay Questions

Total Number of Marks for this section: 50 Marks

This section should be answered in the Answer Booklet provided.

Marks for each question are indicated.

Suggested Time allocation for Section A: **90 minutes**

Question 1

A) Discuss the different safety hazards are routinely experienced by clinical laboratory personal.

B) Briefly outline the biological safety, chemical safety, radiation safety and fire safety in current clinical laboratory practice.

(2x4= 8 Marks)

Question 2

A) Discuss the potential advantages and disadvantages of POCT.

(4 Marks)

B) What are the differences between total calcium, corrected calcium and ionised calcium in blood calcium test?

(4 Marks)

(Total: 8 Marks)

Question 3

Discuss any TWO (2) of the following clinical abnormalities.

I. Causes and classification of hyponatremia by osmolality
II. Consequences and interpretation of hypernatremia
III. Mechanism and evaluation of hypokalaemia

(4+4= 8 Marks)

Question 4

Regarding diagnosis of diabetes mellitus or its complications, write short notes on ANY FOUR (4) of the following:

I. Typical diabetes ketoacidosis (DKA)
II. Oral Glucose Tolerance Test (OGTT)
III. Hyperosmotic non-ketonic coma (HONKC
IV. BSL tests
V. Diabetic retinopathy

(2x4= 8 Marks)

Question 5

A) For mechanisms and response in respiratory acidosis and alkalosis, draw a chart to show the physiological response for hypoventilation and hyperventilation.

(3 Marks)

B) Briefly discuss the compensatory mechanisms through negative feedback and change in renal reabsorption?

(3 Marks)

(Total: 6 Marks)

Question 6

Regarding a routine Full Blood Examination (FBE) report, discuss the importance of following parameters. Give TWO (2) clinical examples for an abnormal count/reading for each.

I. Mean Cell Diameter(MCD)
II. Mean Corpuscular Haemoglobin Concentration (MCHC)
III. Reticulocyte count

(Total: 6 Marks)

Question 7

A) What does it mean by positive troponin level?

(2 Marks)

B) List out the current cardiac marker tests are utilised in clinical practice. Where do these markers originate from, and why are they useful in clinical practice?

(4 Marks)

(Total: 6 Marks)

END OF SECTION A

Section B

Case Study Based Questions

Total Number of Marks for this section: 50 Marks

This section should be answered in the Answer Booklet provided.

Marks for each question are indicated.

Suggested Time allocation for Section B: **90 minutes**

Case study 1

A 58-year-old man with a history of alcoholism complained of increased skin fragility and lesions on his hands, forehead, neck, ears on exposure to the sun. Also noted on physical examination were hyperpigmentation and hypertrichosis. Lab findings showed an increase in urinary uroporphyrin and slight increase in coproporphyrin, with normal levels of aminolevulinic acid (ALA) and porphyrinogen. Isocoporphyrin was elevated in the faeces. Serum ferritin and transaminase were increased. RBC ZPP and FEB were normal.

Questions:

1. What is the probable disorder? (3 Marks)
2. What confirmatory test should be done? (3 Marks)
3. What are the other causes of acquired cases of this type? (4 Marks)
4. How is this type differentiated from other porphyria's causing cutaneous symptoms? (5 Marks)

(Total: 15 Marks)

Case study 2

Mr John is a 60-year-old Darwin man, who presents to the ED with repeated episodes of yellow skin discolouration, on a background of drinking a carton of beer per day. On examination, the man has lots of bruising on his arms as well as a swollen belly and swollen legs. The doctor also orders a full blood examination (FBE) and liver function tests (LFT), the results are as follow:

FBE

•	Hb	100	130-180 g/L
•	RCC	3.2	4.5-6.5 x10^12/ L
•	Hct	34	40-54%
•	MCV	106	80-100 fL
•	Plt	163	150-400x10^9/ L
•	WCC	12.1	5.0-10.0x10^9/ L
•	Neutrophil	8.9	2.0-7.5x10^9/ L

LFT

•	Albumin	15 (L)	32-45 g/L
•	Bilirubin (total)	40 (H)	<20 micromol/L
•	Bilirubin (conjugated)	36 (H)	<4.0 micromol/L
•	ALP	30	25-100 U/L
•	GGT	100(H)	<50 U/L
•	ALT	35	<30 U/L
•	AST	35	<40 U/L

Questions

1. What is the patient status according to these tests? (3 Marks)
2. Why are albumin and some FBE levels low? (4 Marks)
3. What would you expect on the FBE based on the clinical examination? (4 Marks)
4. What other test would you like to complement/confirm the previous finding? What findings will you expect? (4 Marks)

(Total: 15 Marks)

Case study 3

A 60-year man entered Emergency Department after 2 days of “not feeling so well”. History revealed that a myocardial infraction 5 years ago, when he was prescribed digoxin. Two years ago, he was prescribed a diuretic after periodic bouts of oedema. An Electrocardiogram (ECG) at time of admission indicated a cardiac arrhythmia.

Lab results

Venous Blood

Digoxin: 1.4 ng/ml, therapeutic 0.5-2.2

Na =137 mmol/L

K =2.5 mmol/L

Cl =100 mmol/L

HCO_3 =25 mmol/L

Mg =0.4 mmol/L

Ca =1.0 mmol/L (ionised)

Questions:

1. What may be the cause for arrhythmia? (2 Marks)

2. What is the most likely cause for the hypomagnesemia? (2 Marks)

3. What is the most likely cause for decreased K and ionized Ca levels? (3 Marks)

4. What type of treatment would be helpful? (4 Marks)

(Total: 11 Marks)

Case study 4

Louise, an 86-year-old patient with hypertension is brought to the emergency department at Royal Darwin Hospital based in Tiwi. She has had gastroenteritis for 3 days and has become increasingly weak and confused. Her daughter states that her mum takes a "strong water tablet". Her blood pressure is found to be low. Her weight is 66.5 kg. Her medical records from a week ago state her weight as 70kg.

Questions:

1. How, many liters of fluid loss does the weight loss represent, and what is the percentage weight loss? (2 Marks)

2. What is the mechanism of action of diuretics (briefly) and which class is the most potent? (4 Marks)

3. Explain the compensatory mechanisms that were triggered in this patient. (3 Marks)

(Total: 9 Marks)

END OF EXAM

Reference ranges for regular lab tests

Urea and electrolytes (U&E)

Na^+	135.0-145.0 mmol/L
K^+	3.50-4.50 mmol/L (plasma) 3.8-4.9 mmol/L (serum)
Cl^-	95-110 mmol/L
Urea	3.8-8.0 mmol/L
Creatinine	60-100 µmol/L
eGFR	> 90 mL/min/1.73 m^2
Osmolality (serum)	275-295 mOsm/kg
Anion gap	13-17 mEq/L

Calcium, magnesium and phosphate (CMP)

Ca^{2+} (total)	2.1-2.6 mmol/L
Ca^{2+} (ionised)	1.16-1.3 mmol/L
PO_4^{3-}	0.8-1.5 mmol/L
Mg^{2+}	0.8-1.0 mmol/L

Arterial blood gas (ABG)

pH	7.35-7.45
pO_2	80-110 mmHg
pCO_2	35-45 mmHg
Bicarbonate (HCO_3^-)	22-33 mmol/L

Full blood examination (FBE)

Hb	140-174 (male); 120-160 (female) g/L
RCC	4.50-5.50 (male); 4.0-5.0 (female) $x10^{12}$ /L
Haematocrit	0.42-0.52 or 42-52 % (male); 0.36-0.48 or 36-48% (female)
MCV	80.0-100.0 fL
RDW	11.5-14.5 %
Platelets	150-450 ($x10^9$ /L)
WCC	4.0-11.0 ($x10^9$ /L)
Neutrophil	40-80%; or 2.0-7.5 ($x10^9$ /L)
Lymphocytes	20-40%; or 1.5-4.0 ($x10^9$ /L)
Monocytes	2-10%; or 0.2-0.8 ($x10^9$ /L)
Eosinophils	1-6%; or 0.0-0.4 ($x10^9$ /L)
Basophils	<2%; or 0.0-0.1 ($x10^9$ /L)

Liver function test (LFT)

ALT	<30 U/L
AST	<40 U/L
ALP	30-100 U/L
GGT	<30 U/L (female); <50 U/L (male)
Bilirubin (total)	<20 micromol/L
Bilirubin (conjugated)	<4.0 micromol/L
Albumin	32-45 g/L
Total protein	63-80 g/L
Pancreatic lipase	8 – 78 U/L

Thyroid function test (TFT)

TSH	0.4-5.0 mU/L
T4 (free)	10-25 pmol/L
T3 (free)	3.0-6.5 pmol/L

Carbohydrate metabolism

BSL (random)	3.0-7.7 mmol/L
BSL (fasting)	3.0-5.5 mmol/L
HbA1c (non-DM)	4.3-5.7% (NGSP); 23-39 mmol/mol (IFCC)
HbA1c (DM) therapeutic target	<7% *

Fasting lipid biochemistry

Total cholesterol	<5.5 mmol/L
LDL	2-3.4 mmol/L
HDL	>1 mmol/L
Non-HDL cholesterol	<2.5 mmol/L
TG	<1.7 mmol/L

Others

Troponin T	<0.01 µg/L
CRP	<3 mg/L
D-dimer	<500 µg/L
BNP	<20 nmol/L